

What is Claimed:

- 1 1. A portable electric heater for providing a heated exhaust air
2 stream at an elevation above a support surface, said portable electric heater
3 comprising:
 - 4 an elongate housing having at least one sidewall, a top end, a bottom
5 end, and a longitudinal length extending substantially upward from said bottom end
6 to said top end, and a horizontal cross sectional area;
 - 7 a base for supporting said elongate housing in a vertical and upright
8 position on said support surface, said base contacting said support surface;
 - 9 at least one interior space within said elongate housing;
 - 10 at least one inlet opening in said elongate housing allowing inlet air to
11 enter said at least one interior space;
 - 12 an air blower assembly disposed within said at least one interior space
13 for receiving said inlet air, said air blower assembly comprising:
 - 14 i) at least one air impeller, and
 - 15 ii) at least one motor for rotating said air impeller to generate
16 an exhaust air stream;
 - 17 at least one outlet opening in said elongate housing allowing said
18 exhaust air stream to exit said at least one interior space; and

19 at least one electric heating element disposed within said at least one
20 interior space between said air blower assembly and said at least one outlet opening,

21 wherein a substantial portion of said exhaust air stream passes
22 through said at least one electric heating element and thermal energy is transferred
23 from said at least one electric heating element to said exhaust air stream as said
24 exhaust air stream flows through said at least one electric heating element forming
25 said heated exhaust air stream,

26 said heated exhaust air stream exits said elongate housing at an
27 elevation above said support surface, said elevation being defined by a distance from
28 where said base contacts said support surface to a highest vertical exit point of said
29 heated exhaust air stream from said at least one interior space; and

30 said elevation of said heated exhaust air stream being about 20 inches
31 or greater.

1 2. The portable electric heater of claim 1, wherein an overall
2 length is defined by the distance from where said base contacts said support surface
3 to said top end of said elongate housing.

1 3. The portable electric heater of claim 2, wherein said overall
2 length is about 25 inches or greater.

1 4. The portable electric heater of claim 3, having a vertical aspect
2 ratio defined by said overall length to a maximum width dimension of said horizontal

3 cross sectional area of said elongate housing, wherein said vertical aspect ratio is
4 greater than about 2 to 1.

1 5. The portable electric heater of claim 3, wherein said base
2 comprises a maximum width dimension of a horizontal cross section through said
3 base, and said maximum width dimension of said horizontal cross section through
4 said base is less than about 60% of said overall length.

1 6. The portable electric heater of claim 1, wherein a first
2 comparative ratio is defined by said elevation of said heated exhaust air stream to a
3 maximum width dimension of said horizontal cross sectional area of said elongate
4 housing, said first comparative ratio being greater than about 2 to 1.

1 7. The portable electric heater of claim 1, wherein said air blower
2 assembly further comprises a transverse blower assembly.

1 8. The portable electric heater of claim 7, wherein said air blower
2 assembly is a pre-assembled cartridge, and said pre-assembled cartridge is pre-
3 tested and installed in said elongate housing during assembly of said portable
4 electric heater.

1 9. The portable electric heater of claim 1, wherein said air blower
2 assembly further comprises a centrifugal blower assembly.

1 10. The portable electric heater of claim 1, wherein said air impeller
2 further comprises a diameter of said air impeller and a length of said air impeller and

3 a ratio of said length of said air impeller to said diameter of said air impeller being
4 greater than about 2:1

1 11. The portable electric heater of claim 1, further comprising a
2 controller for controlling at least one function of said portable electric heater.

1 12. The portable electric heater of claim 11, wherein said controller
2 is mounted to one of said elongate housing and said base.

1 13. The portable electric heater of claim 11, wherein said controller
2 is a remote control device.

1 14. The portable electric heater of claim 11, wherein said motor
2 further comprises a variable speed motor having one or more rotational speeds, and
3 said controller controls said rotational speeds.

1 15. The portable electric heater of claim 1, wherein said elongate
2 housing rotates or oscillates relative to said support surface, wherein said rotation or
3 oscillation is about an axis of rotation, said axis of rotation being substantially
4 aligned with a vertical longitudinal axis of said elongate housing.

1 16. The portable electric heater of claim 15, wherein said axis of
2 rotation of said elongate housing is substantially parallel to the axis of rotation of
3 said at least one impeller of said air blower assembly.

1 17. The portable electric heater of claim 15, further comprising a
2 mechanism for rotating or oscillating said elongate housing relative to said support
3 surface.

1 18. The portable electric heater of claim 17, wherein said
2 mechanism is disposed between said bottom end of said elongate housing and said
3 base.

1 19. The portable electric heater of claim 17, further comprising a
2 controller for controlling a function of said mechanism for rotating or oscillating said
3 elongate housing with respect to said support surface.

1 20. The portable electric heater of claim 1, wherein said at least
2 one outlet opening further comprises an elongate outlet opening in said at least one
3 sidewall and oriented substantially along said longitudinal length of said elongate
4 housing, wherein said elongate outlet opening allows said exhaust air to exit said
5 interior space as an elongate exhaust air stream.

1 21. The portable electric heater of claim 1, further comprising a grill
2 covering said at least one outlet opening.

1 22. The portable electric heater of claim 21, wherein a highest
2 elevation of an extent of said grill above said support surface is about 21 inches or
3 greater.

1 23. The portable electric heater of claim 21, wherein said grill
2 further comprises air directing vanes that can be positioned to direct said heated
3 exhaust air stream exiting said elongate housing to a desired location.

1 24. The portable electric heater of claim 21, wherein said grill is an
2 integral part of said elongate housing.

1 25. The portable electric heater of claim 21, further comprising an
2 air containment frame disposed between said at least one electric heating element
3 and said grill, wherein said air containment frame is a distinct and separate part from
4 said grill.

1 26. The portable electric heater of claim 25, further comprising air
2 alignment elements disposed between said at least one electric heating element and
3 said grill, wherein said alignment elements are distinct and separate parts from said
4 grill.

1 27. The portable electric heater of claim 26, wherein said air
2 containment frame and said air alignment elements are integral to each other as a
3 single part.

1 28. The portable electric heater of claim 26, wherein at least one of
2 said air containment frame or said air alignment elements are integral to at least one
3 of said housing or said at least one electric heating element.

1 29. The portable electric heater of claim 1, wherein heated exhaust
2 air stream exiting said elongate housing comprises a single substantially contiguous
3 elongated column of heated exhaust air.

1 30. The portable electric heater of claim 1, wherein said at least
2 one electric heating element is a positive temperature coefficient (PTC) heating
3 element capable of producing about 1500 watts of energy.

1 31. The portable electric heater of claim 30, wherein said at least
2 one electric heating element comprises an elongate electric heating element disposed
3 proximate said outlet opening and is oriented substantially along said longitudinal
4 length of said elongate housing, said elongate electric heating element further
5 comprising a vertical aspect ratio defined by a length of said elongate electric heating
6 element being greater than a width of said elongate electric heating element.

1 32. The portable electric heater of claim 31, wherein said vertical
2 aspect ratio of said elongate electric heating element is greater than about 7.5:1.

1 33. The portable electric heater of claim 31, wherein said length of
2 said elongate electric heating element is about 13 inches or greater.

1 34. The portable electric heater of claim 31, wherein said width of
2 said elongate electric heating element is about 1.5 inches or less.

1 35. The portable electric heater of claim 31, wherein said elongate
2 electric heating element utilizes a row of PTC ceramic stones flanked on at least one
3 side by heat dissipation fins.

1 36. The portable electric heater of claim 35, wherein said row of
2 PTC ceramic stones is a single row aligned substantially linearly in a substantially
3 vertical orientation.

1 37. The portable electric heater of claim 31, wherein a second
2 comparative ratio is defined by said elevation of said heated exhaust air stream to
3 said width of said elongate electric heating element, said second comparative ratio
4 being at greater than about 12 to 1.

1 38. The portable electric heater of claim 1, wherein said base is a
2 unitary part of said elongate housing.

1 39. The portable electric heater of claim 1, wherein said base is
2 detachably coupled to said elongate housing having i) an operating configuration
3 when said base is coupled to said elongate housing and ii) a non-operating
4 configuration when base is detached from said elongate housing.

1 40. The portable electric heater of claim 39, wherein said non-
2 operating configuration is disposed in a package for shipment.

1 41. The portable electric heater of claim 39, wherein said base
2 further comprises a split base having at least a first portion and a second portion that
3 can be separated.

1 42. The portable electric heater of claim 1, wherein said support
2 surface is a substantially vertical surface and further comprising at least one

3 mounting means for mounting said portable electric heater to said substantially
4 vertical surface.

1 43. The portable electric heater of claim 42, wherein said at least
2 one mounting means and said base comprise a unitary component.

1 44. The portable electric heater of claim 42, wherein said at least
2 one mounting means and said elongate housing comprise a unitary component.

1 45. The portable electric heater of claim 42, wherein said at least
2 one mounting means is a bracket.

1 46. A portable electric heater for providing a heated exhaust air
2 stream at an elevation above a support surface, said portable electric heater
3 comprising:

4 an elongate housing having at least one sidewall, a top end, a bottom
5 end, and a longitudinal length extending substantially upward from said bottom end
6 to said top end, and a horizontal cross sectional area;

7 a base for supporting said elongate housing in a vertical and upright
8 position on said support surface, said base contacting said support surface;

9 at least one interior space within said elongate housing;

10 at least one elongate electric heating element disposed within said at
11 least one interior space and oriented substantially along said longitudinal length of

12 said elongate housing, a length of said at least one elongate electric heating element
13 being about 13 inches or greater;

14 at least one inlet opening in said elongate housing allowing inlet air to
15 enter said at least one interior space;

16 an air blower assembly disposed within said at least one interior space
17 between said at least one inlet opening and said at least one elongate electric
18 heating element, said air blower assembly comprising: i) at least one air impeller; ii)
19 at least one motor for rotating said air impeller to receive said inlet air and generate
20 an exhaust air stream; and

21 at least one outlet opening in said elongate housing allowing said
22 heated exhaust air stream to exit said at least one interior space,

23 wherein a substantial portion of said exhaust air stream passes
24 through said at least one elongate electric heating element and thermal energy is
25 transferred from said at least one elongate electric heating element to said exhaust
26 air stream as said exhaust air stream flows through said at least one elongate
27 electric heating element to form said heated exhaust air stream.

1 47. The portable electric heater of claim 46, wherein said heated
2 exhaust air stream exits said elongate housing at an elevation above said support
3 surface, said elevation being defined by a distance from where said base contacts
4 said support surface to the highest vertical exit point of said heated exhaust air
5 stream from said at least one interior space.

1 48. The portable electric heater of claim 47, comprising a
2 comparative ratio defined by said elevation of said heated exhaust air stream to a
3 width of said elongate electric heating element, said comparative ratio being at
4 greater than about 12 to 1.

1 49. The portable electric heater of claim 47, wherein said elevation
2 of said heated exhaust air stream is about 20 inches or greater.

1 50. The portable electric heater of claim 46, wherein said at least
2 one electric heating element is a positive temperature coefficient (PTC) heating
3 element.

1 51. The portable electric heater of claim 50, wherein a width of said
2 at least one elongate electric heating element is about 1.5 inches or less.

1 52. The portable electric heater of claim 50, further comprising a
2 row of PTC ceramic stones flanked on at least one side by heat dissipation fins,
3 wherein said row of PTC ceramic stones is a single row aligned substantially linearly
4 in a substantially vertical orientation.

1 53. The portable electric heater of claim 50, wherein said at least
2 one elongate electric heating element further comprises a vertical aspect ratio
3 greater than about 7.5:1, defined by said length of said at least one elongate electric
4 heating element being greater than a width of said at least one elongate electric
5 heating element.

1 54. The portable electric heater of claim 46, wherein said heated
2 exhaust air stream exiting said elongate housing comprises a single substantially
3 contiguous elongated column of heated exhaust air.

1 55. The portable electric heater of claim 46, further comprising a
2 grill covering said at least one outlet opening.

1 56. The portable electric heater of claim 55, wherein a highest
2 elevation of an extent of said grill above said support surface is about 21 inches or
3 greater.

1 57. A portable electric heater for providing a heated exhaust air
2 stream at an elevation above a support surface, said portable electric heater
3 comprising:

4 an elongate housing having at least one sidewall, a top end, a bottom
5 end, and a longitudinal length extending substantially upward from said bottom end
6 to said top end, and a horizontal cross sectional area;

7 a base for supporting said elongate housing in a vertical and upright
8 position on said support surface, said base contacting said support surface;

9 an overall length defined by the distance from where said base
10 contacts said support surface to said top end of said elongate housing, wherein said
11 overall length being about 25 inches or greater;

12 said elongate housing further comprising a maximum width dimension
13 of a horizontal cross sectional area, a vertical aspect ratio defined by said overall
14 length to said maximum width dimension and being greater than about 2 to 1;

15 at least one interior space within said elongate housing;

16 at least one inlet opening in said elongate housing allowing inlet air to
17 enter said at least one interior space;

18 an air blower assembly disposed within said at least one interior space
19 for receiving said inlet air, said air blower assembly comprising: at least one air
20 impeller and at least one motor for rotating said air impeller to generate an exhaust
21 air stream;

22 said at least one air impeller further comprising:

23 i) a length of said at least one air impeller,

24 ii) a diameter of said at least one air impeller, and

25 iii) an aspect ratio of said length of said at least one air impeller
26 to said diameter of said at least one air impeller being greater than 2 to 1;

27 at least one outlet opening in said elongate housing allowing said
28 exhaust air stream to exit said at least one interior space; and

29 at least one electric heating element disposed within said at least one
30 interior space between said air blower assembly and said at least one outlet opening,

31 wherein a substantial portion of said exhaust air stream passes
32 through said at least one electric heating element and thermal energy is transferred
33 from said at least one electric heating element to said exhaust air stream as said
34 exhaust air stream flows through said at least one electric heating element forming
35 said heated exhaust air stream.

1 58. The portable electric heater of claim 57, wherein said base is a
2 unitary part of said elongate housing.

1 59. The portable electric heater of claim 57, wherein said base is
2 decoupled from said elongate housing in a non-operating configuration .

1 60. The portable electric heater of claim 59, wherein said base
2 further comprises a split base having at least a first portion and a second portion that
3 can be separated.

1 61. The portable electric heater of claim 59, wherein said non-
2 operating configuration is disposed in a package for shipment from a place of
3 manufacturing to a place of sale.

1 62. The portable electric heater of claim 57, wherein said base
2 further comprising a maximum width dimension of a horizontal cross section through
3 said base and said maximum width dimension of a horizontal cross section through
4 said base is less than about 60% of said overall length.

1 63. The portable electric heater of claim 57, wherein said heated
2 exhaust air stream exits said elongate housing at an elevation above said support

3 surface, said elevation being defined by a distance from where said base contacts
4 said support surface to the highest vertical exit point of said heated exhaust air
5 stream from said at least one interior space.

1 64. The portable electric heater of claim 63, wherein said elevation
2 of said heated exhaust air stream is about 20 inches or greater.

1 65. A portable electric heater for providing a heated exhaust air
2 stream, said portable electric heater comprising:

3 a housing having at least one sidewall, a top end, a bottom end, and a
4 length extending substantially upward from said bottom end to said top end, and a
5 horizontal cross sectional area;

6 a base for supporting said housing in a upright position on a support
7 surface, said base contacting said support surface;

8 at least one interior space within said housing;

9 at least one inlet opening in said housing allowing inlet air to enter
10 said at least one interior space;

11 an air blower assembly disposed within said at least one interior space
12 for receiving said inlet air, said air blower assembly comprising:

13 i) at least one air impeller, and

14 ii) at least one motor for rotating said air impeller to generate
15 an exhaust air stream;

16 at least one outlet opening in said housing allowing said exhaust air
17 stream to exit said at least one interior space;

18 at least one electric heating element disposed within said at least one
19 interior space between said air blower assembly and said at least one outlet opening;

20 a grill covering said at least one outlet opening; and

21 an air containment frame disposed between said electric heating
22 element and said grill, wherein said air containment frame is a distinct and separate
23 part from said grill.

24 wherein a substantial portion of said exhaust air stream passes
25 through said at least one electric heating element and thermal energy is transferred
26 from said at least one electric heating element to said exhaust air stream as said
27 exhaust air stream flows through said at least one electric heating element forming
28 said heated exhaust air stream, and said containment frame prevents the said
29 heated exhaust air stream from expanding into an area between said heating
30 element and said grill.

1 66. The portable electric heater of claim 65, further comprising air
2 alignment elements disposed between said electric heating element and said grill,
3 wherein said alignment elements are distinct and separate parts from said grill.

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1 67. The portable electric heater of claim 66, wherein said air
2 containment frame and said air alignment elements are integral to each other as a
3 single part.

1 68. The portable electric heater of claim 66, wherein at least one of
2 said air containment frame or said air alignment elements are integral to at least one
3 of said housing or said at least one electric heating element.

1 69. The portable electric heater of claim 65, wherein an overall
2 length is defined by the distance from where said base contacts said support surface
3 to said top end of said housing.

1 70. The portable electric heater of claim 69, further comprising a
2 vertical aspect ratio defined by said overall length to a maximum width dimension of
3 said horizontal cross sectional area of said elongate housing, wherein said vertical
4 aspect ratio is greater than about 2 to 1.

1 71. The portable electric heater of claim 70, wherein a highest
2 elevation of an extent of said grill above said support surface is about 21 inches or
3 greater.

1 72. The portable electric heater of claim 65, wherein said grill is an
2 integral part of said housing.

1 73. The portable electric heater of claim 65, wherein said at least
2 one electric heating element comprises an elongate electric heating element, said
3 elongate electric heating element further comprising a vertical aspect ratio defined
4 by a length of said elongate electric heating element being greater than a width of
5 said elongate electric heating element.

1 74. The portable electric heater of claim 73, wherein said at least
2 one electric heating element is a positive temperature coefficient (PTC) heating
3 element.

1 75. The portable electric heater of claim 74, wherein said length of
2 said elongate electric heating element is about 13 inches or greater.

1 76. The portable electric heater of claim 74, wherein said vertical
2 aspect ratio of said elongate electric heating element is greater than about 7.5:1.

1 77. The portable electric heater of claim 74, wherein said width of
2 said at least one elongate electric heating element is about 1.5 inches or less.

1 78. The portable electric heater of claim 74, further comprising a
2 row of PTC ceramic stones flanked on at least one side by heat dissipation fins,
3 wherein said row of PTC ceramic stones is a single row aligned substantially linear in
4 a substantially vertical orientation.